Regarding:
ET Docket No. 02-135
Comments to the Spectrum Policy Task Force on Issues Related to Spectrum Policies of the Federal Communications Commission

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Introduction:
The aspects and needs of passive services utilizing the radio spectrum are often not given due weight in the consideration of spectrum allocation but are equally if not more socially and economically significant than the allocations of active users.

Passive Use of the Electromagnetic Spectrum:
Passive users of the radio spectrum are unique in that their use does not involve the artificial generation of radio frequency energy, commonly called 'transmitting'. Instead they receive only, relying on natural processes that generate radiation across the electromagnetic spectrum to provide their signals or data. All matter absorbs, emits and scatters electromagnetic energy. The detection and analysis of these processes are the basis of the passive uses of the electromagnetic spectrum mentioned in these comments.

Particularly useful is radiation in the microwave and sub microwave frequency range. These signals are not significantly affected by daylight or cloud cover and are thus useful during daytime, night time and in nearly all types of weather. This range of frequencies can also allow the detection of variations in earth parameters not readily detected in the optical and infrared range and over a much wider geographical area than can be realistically covered with methods such as weather stations or physical sampling. Atmospheric gas measurements, soil moisture content and wind speeds and directions are all possible by passive use of this range of the spectrum.

Radio astronomy is looking up, literally. By collecting and examining the radiation from near and distant celestial objects vast amounts of information can be obtained regarding the origins, composition and behavior of the universe we live in. Technological advances in instrumentation are now providing researchers with the capability of literally examining space to the edges of the known universe. These examinations give insight into how our physical world works over the celestial to microscopic to sub nuclear scales.

The processes that cause the radiation utilized by passive users is governed by the physical laws of the universe, some still to be discovered by researchers. These laws dictate where in the electromagnetic spectrum radiation will occur, at what field strengths they might be expected and over what range of spectrum the initial emissions may be Doppler shifted due to the relative motions of the sources. These emission spectra transcend any artificial allocation, they are what they are and no mortal being will alter them in the foreseeable future if ever. The International Telecommunications Union (ITU) among other organizations has record of extensive studies performed to

quantify the frequencies and bandwidths of known scientific interest. A sampling of these are documented in ITU Recommendations ITU-R SA.515-3 for passive sensor measurements and ITU-R RA.314-8 for radio astronomy. In examining the tables of frequencies and bandwidths contained in these recommendations one will note the wide range of overall frequency coverage but that particular bands cover a small percentage of the actual spectrum.

All users of the electromagnetic spectrum must be protected from interference to some degree or another. Passive users in general will require more protection than other users due to the sources of radiation they collect and analyze having a much lower signal strength than the radio transmitters of active users. The sensitivity of radiometers and receivers now used in the passive services is such that even users in adjacent allocations can be well within current regulatory standards for emission in adjacent spectrum and still be causing detrimental interference to passive users to the extent that the passive user is no longer able to use their specifically allocated spectrum. I refer the reader to ITU Recommendation ITU-R RA.769 for the protection criteria used for radio astronomy and to ITU document 7D/86-E (4 February 2002) for an assessment of the impact on radio astronomy of unwanted emissions in excess of those defined in ITU-R RA.769.

I now wish to address some of the categories of questions posed in ET Docket 02-135.

Market-Oriented Allocation and Assignment Policies:
Passive users are by and large non-profit oriented research organizations and therefore their use of the spectrum is not driven by market economics. Passive users are utilizing spectrum to expand the pool of mankind's knowledge and to benefit the efforts of man by providing knowledge of fields such as physics, agriculture, climate and weather. As has been previously demonstrated innumerable times the final value of knowledge cannot be assessed at the time of its acquisition and frequently that value turns out to be many times greater than anticipated. For these reasons spectrum allocated to passive services cannot be valued in the same way allocations for commercial use and from some perspectives it is actually of greater value.

Interference Protection:
As stated above and in ITU documentation interference to passive users can be devastating. Passive users do not have the option afforded active users of simply changing frequencies, passive users are dictated what frequencies to use by the laws of physics. These laws also rule radio propagation in somewhat unpredictable ways and the antennas used by passive users are real devices with finite capabilities, they cannot completely exclude interfering radiation from off axis sources. These are but two reasons why geographic separation of active and passive users of the same portion of spectrum is insufficient to protect passive users. Passive users must have passive-only allocated spectrum, that spectrum must be allocated according to its scientific value and adjacent spectrum must be allocated with the neighboring passive users in mind, be those allocations considered geographically or by service such that neighbors to the passive service will not cause detrimental interference.

International Issues:
Electromagnetic radiation knows no political boundaries. The United States is a world leader in scientific research and should carry this leadership to regional and international meetings on spectrum policy and strive to keep passive spectrum allocations in place, free of interference and encroachment and encourage other countries to join in expanding the spectrum allocated to passive services.

Conclusion:
Technology can ensure that there is plenty of spectrum available for everyone's uses, be they citizens, commercial interests or researchers. Electromagnetic spectrum is a limited resource that cannot be valued by economic standards alone. The Federal Communications Commission by adopting an encompassing spectrum policy formed with the input of all spectrum users can ensure that we all have the spectrum we need for our wide range of uses.

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